DOCKET NO.: 0059-1219-0X

IN THE UNITED STATES PATENT & TRADEMARK OFFICE

IN RE APPLICATION OF :

Kazuyuki MURAKAMI et al : EXAMINER: VANOY, T. C.

SERIAL NO: 09/559,073 :

FILED: APRIL 27, 2000 : GROUP ART UNIT: 1754

CPA FILED: April 11, 2003 :

FOR: CARBONACEOUS MATERIAL, ITS PRODUCTION PROCESS AND ELECTRIC DOUBLE LAYER CAPACITOR EMPLOYING IT :

APPEAL BRIEF

COMMISSIONER FOR PATENTS
ALEXANDRIA, VA. 22313

SIR:

The following is an appeal to the Board of Appeals concerning the final decision by the Examiner to reject Claims 17-24, 31-33 and 38-49 of the above-identified application.

REAL PARTY IN INTEREST

ASAHI GLASS Co. Ltd. and ADCHEMCO Corp. are the real parties of interest in the above-identified application.

RELATED APPEALS AND INTERFERENCES

There are no appeals or interferences before the Board of Appeals in applications related to the present application.

STATUS OF CLAIMS

Claims 1-16, 25-30 and 34-37 have been canceled. Claims 17-24, 31-33 and 38-49 are under active consideration.

STATUS OF AMENDMENTS

No amendment in response to the Office Action dated May 30, 2003 has been filed.

SUMMARY OF THE INVENTION

The present invention is directed to a carbonaceous material which has a total pore volume of from 0.5 to 1.5 cm^3/g per unit mass, a volume of micropores having diameters of from 10 to 20 Å of from 10 to 45 % based on the total pore volume, a volume of mesopores having diameters of from 20 to 200 Å of from 35 to 65 % based on the total pore volume, a volume of macropores having diameters exceeding 200 Å of not more than 15 % based on the total pore volume, and a specific surface area of from 1,000 to 2,500 m^2/g.

Another aspect of the invention is an electric double layer capacitor that has electrodes which comprise a carbonaceous material having the characteristics stated above.

Still another aspect of the invention is a process for producing an electric double layer capacitor having electrodes comprising a porous carbonaceous material and a binder, wherein the carbonaceous material is prepared by (1) curing a liquid thermosetting resin which contains a volatile component having a boiling point of from 120 to 400° C and which has a viscosity of from 0.1 to 100 Pa·s at 25° C to obtain a cured product, (2) pulverizing the cured product, (3) carbonizing the pulverized, cured product in a non-oxidizing atmosphere so that the mass reduction till 400° C in the carbonization is from 2 to 50 mass % of the mass

before carbonization, to obtain a carbonized product, and (4) activating the carbonized product.

A second process embodiment for producing a porous carbonaceous material comprises (1) combining a liquid thermosetting resin which contains a volatile component having a boiling point ranging from 150° to 380° C and which has a viscosity ranging from 0.2 to 80 Pa·s at 25° C and at least 1 mass % of a curing agent, based on the thermosetting resin, (2) curing the resin to form a cured product, (3) pulverizing the cured product, (4) carbonizing the pulverized cured product in a non-oxidizing atmosphere so that the mass reduction which occurs upon heating up to a temperature of 400° C during carbonization ranges from 2 to 50 mass % of the mass before carbonization, thereby obtaining a carbonized product, and (5) activating the carbonized product.

Support for the various aspects of the invention can be found on pages 8 and 9 of the text, as well as the paragraph bridging pages 12 and 13 and the paragraph bridging pages 16 and 17 of the text. The latter portions of text are particularly relevant to Claim 44..

ISSUES

1. Whether Claims 17-24, 31, 38, 42 and 43 are obvious based on 35 USC 103(a) over JP 06-216,446 in view of JP 4-175,277.

2. Whether Claims 17-24, 31 and 38-43 are obvious based on 35 USC 103(a) over JP 06-216,446 in view of JP 4-175,277 and further in view of JP 5-243,092 and JP 2-297,915.

3. Whether Claims 17-24, 31, 32, 33 and 38-43 are obvious based on 35 USC 103(a) over JP 06-216,446 in view of JP 4-175,277 and further in view of JP 5-243,092 and JP 2-297,915 and still further in view of Hiratsuka et al, U.S. Patent 5,754,393.

4. Whether Claims 44-49 are obvious based on 35 USC 103(a) over JP 06-216,446 in view of JP 4-175,277 and further in view of JP 5-243,092 and JP 2-297,915.

GROUPING OF CLAIMS

Claims 18-20, 23, 39, 43, 45, 48 and 49 do not stand or fall together with the independent claims.

ARGUMENT

As appellants have stated on the record, the JP 06-216,446 in disclosing a method of preparing a carbonized product for use as a an active carbon electrode, merely describes the use of a phenolic resin as the starting material for the preparation of activated carbon, but fails to disclose whether the phenolic resin is liquid or solid. This fact is significant because in order to prepare a carbonaceous material as claimed in Claim 17 (31), it is essential to start with a liquid thermosetting resin as described in Claim 38 which has the stated boiling point range and viscosity range as determined at 25° C. On the other hand, in describing the preparation of the carbon material of the patent, all that is mentioned in the patent is that a solid carbon containing material is used such as coconut shell char, wood, coal, pitch, natural macromolecules or synthetic macromolecules, with phenol resin preferred. The examples only speak of a novolak type phenol resin. However, none of these materials when processed to a carbonized and activated product result in the carbonaceous product of the present invention. This fact has been clearly demonstrated by the experiment described and presented in the Declaration (37 CFR 1.132) filed June 5, 2003 (a copy is enclosed) where a solid novolak type phenol resin is processed as described in the '446 reference. The result of the experiment is that a carbonized product is obtained that has a micropore, mesopore,

macropore distribution completely outside the content ranges required of the claimed carbonaceous material of the present invention (see the table below).

Pore Volumes	Claim 17 of present application	Carbonized product of the '446 reference
Volume of micropores having diameters of 10-20 Å	10 - 45 %	27 %
Volume of mesopores having diameters of 20-200 Å	35 -65 %	15 %
Volume of macropores having diameters greater than 200 Å	at most 20 %	9 %

It is clear from the data above that the carbonized product of the reference has a volume of mesopore content well outside the required range of the present claims which means that in view of the function of mesopores which is to supply electrolyte ions within the carbon product to the micropores within the carbon material, the carbon product of the reference is materially and obviously different from the claimed product of the present invention. (Appellants in this regard refer to the important discussion in the specification regarding the different roles of micropores, mesopores and macropores within a carbon electrode. In particular, appellants direct attention of the reader to the discussion on pages 3-7 and, in particular, the discussion from page 9, line 18 to page 12, line 19. The amounts of micropores, mesopores and macropores within a carbon electrode are very important if the electrical characteristics of an electric double layer capacitor are to be maximized.)

The Examiner seems to make an issue of appellants' statement concerning the lack of disclosure in the reference of the use of a solid or liquid resin. Obviously, however, if the novolak resin of the reference is a solid, it **can not** have the viscosity and boiling point

characteristics of the liquid thermosetting resin starting material of the present claims. On the other hand, if the novolak phenolic resin of the reference is liquid, there is no disclosure in the reference that teaches the boiling point and viscosity ranges of the present claims, nor is there any disclosure that teaches that these characteristics are in any way important in obtaining a carbonized product that exhibits improved electrical properties as an electrode of a capacitor!

At this point in the discussion appellants believe that the importance of using the volatile component of the present invention having a particular boiling point range and viscosity range should be established. On fact, attention is directed to Comparative Examples 1, 2, 4 and 9 of the specification. Specifically, in Comparative Example 1, the volatile component has a viscosity of 0.08 Pa·s, whereas in Comparative Example 2, the volatile component has a viscosity of 120 Pa·s. That is, in Comparative Example 1, the viscosity is below that required in accordance with the present invention, whereas in Comparative Example 2, the viscosity is above that required by the present invention.

In Comparative Example 4, the volatile component has a boiling point ranging from 390° to 460°C, which is higher than that required by the present invention. Additionally, in Comparative Example 9, a curing agent is not used, unlike that of the present process.

The results of these comparative examples are shown in Table 1. Comparative Example 1 provides a product in which the amount of mesopores is below that of the present invention. Comparative Examples 2 and 4 also afford products having too few mesopores as compared to the product of the present invention. Comparative Example 2 also provides a product having a pore volume which is below that of the present invention, whereas Comparative Example 9 affords a pore volume which is too high relative to the present invention.

Furthermore, in all of Comparative Examples 1, 2, 4 and 9, the capacitances obtained are too low and the internal resistances (electrical resistivity) are much higher than obtained in the product of the present invention. Clearly, there is a direct influence of the boiling point and viscosity of the volatile component on the resulting pore structure of the carbonaceous material produced. Clearly, '446 does not teach or suggest the carbonaceous product of the invention, nor does it teach or suggest the process embodiments of the invention for producing the present product.

In this connection the Examiner alleges at page 13, last paragraph of the final Office Action that the phenolic resin of the JP '277 reference, also cited against the present claims, is the same as that of '446 and that of the present invention. Appellants do not comprehend how such a conclusion can be reached since the inventive entity/assignee designations of the '277 and '446 references are totally different and because the types of phenolic resins used in the two references are substantially different because '446 uses a **novolak** phenolic resin and '277 uses a **resol** type phenolic resin. Anyone of skill in the art knows that a novolak resin is fundamentally of different structure than an A-stage resole resin.

Appellants also note that a material difference between the claimed process of the invention and the process of '446 is that in the present invention, the resin employed is cured and the cured material obtained is then pulverized, followed by carbonization. On the other hand, in '446, primary activation of the carbonaceous material is conducted subsequent to carbonization, followed by grinding of the cured product. (See Experiment 1 of the '867 U. S. Patent.) The significance of this basic difference in process is that when a material within the scope of the present invention is subjected to carbonization, desorption of volatile components during the operation occurs which results in the formation of mesopores. Because the present claims require pulverization of the cured resin prior to carbonization,

mesopores tend to be formed in the product with uniformity. On the other hand, if a cured product in the form of a block is carbonized such as taught by '446, mesopores are formed in a non-uniform manner. Moreover, if a cured product is carbonized without pulverization, hard charcoal forms as blocks. Subsequent pulverization then tends to be troublesome and takes a long time. Thus, there are very material differences between the present invention as claimed in Claims 17, 31 and 38 and the process disclosed in '446.

Turning to the JP 4-175,277 reference, the same describes the use of a liquid phenolic resin (resol type) as a material to produce activated carbon. However, an evaporation type foaming agent is mixed into the resin for treatment, the result of which, upon carbonization and activation, is the formation of a substantial amount of macropores having pore diameters in excess of 200 Å. This fact is particularly noteworthy in view of the specific distribution of micropores, mesopores and macropores in the product of the present invention, which distribution of the three types of pores in a carbon product is not taught or suggested by '277. In view of the formation of substantial amounts of macropores in the product of the reference because of the use of a foaming agent, the carbon product of the reference has a very different micropore/mesopore/macropore distribution in comparison to the carbonaceous product of the present invention. The process of the present invention, fundamentally is quite different from that of the '277 reference. As is clear from the abstract of the reference a sheet of material is prepared from the mixture of the reference containing surfactant and other ingredients, which is subsequently cured and then carbonized. The carbonized sheet is used as an electrode. On the other hand, in the present invention an activated carbon powder is obtained which is formulated with a binder to form a sheet electrode. Thus, it is clear that the process of the reference is very different, not only from that of the present invention, but also that of the '446 disclosure. In fact, it is not clear how the two references can be combined to

suggest the present process. Whereas the '446 reference requires the curing of a solid novolak type phenolic resin followed by fracturing of the cured material into relatively large size square cubes which are then carbonized and then activated followed by pulverization, the '277 reference shapes the mixture noted above of a resol type phenolic resin and surfactant as well as other ingredients into the shape of an electrode which is then followed by curing, carbonization and activation of the shaped material. Thus, the two procedures are so different, it is not apparent how the two can be combined in some reasonable manner, and certainly not in a way in which the two references suggest either the product of the present invention or the process by which the product is made.

As to the combination of the two references, the Examiner states in paragraph (e) on page 16 of the Office Action that the combination of the two references will result in a "product that will produce a product" having the same inherent micropores since the processes are the same. Besides the fact that a product can not produce a product, it is not clear how it is apparent that the products of the two references inherently apparently have the same volume of mesopores. How does the Examiner arrive at this conclusion? In fact, the two products of the references can not have the "same inherent mesopores" because the processes of the two references are obviously not the same, but rather as noted above are quite different from each other.

The Examiner states on page 5 of the Office Action (reference is also made to comments of paragraph (g) on page 17 of the Office Action) that it would be obvious to one of skill to combine the teachings of '446 and '277 with respect to the resin formulations described and somehow arrive at the resin used in the present process. In view of the fact that '446 only describes the curing of a novolak resin, why would one of skill employ the "glycerols" and/or "oxyalkylene compounds" which make-up a formulation of '277 in which

a liquid A-stage resole type phenolic resin is used when the disclosure of '446 requires the presence of no such ingredients with the solid novolak resin. Even if one of skill made such a modification, how does one arrive at the thermosetting resin starting material of the present process which must have the particular boiling point range and viscosity range as stated? Appellants are therefore of the opinion that the cited and applied references do not suggest any of the claimed aspects of the present invention.

Appellants wish to emphasize that in order to establish a *prima facie* case of obviousness, three criteria must be met. The first is that there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art to modify the reference or to combine reference teachings. In the present situation each of the '446 and '277 references describes a separate method of forming an electrode by an orderly progression of steps, each of which sequence of steps starts with a specified thermosetting resin formulation . In fact, '446 describes only a first step of curing a solid novolak phenol resin while '277 describes the curing of a resin containing composition, not based on a novolak resin, but based on a resole (A-stage phenol resin) (fluid) that is used in combination with a surfactant, an oxyalkylene compound or glycerol and a high-boiling lipophilic compound. In view of the very substantial difference in starting materials, why would one of skill in the art be led to make substantive changes to the make-up of resin starting materials in overall processes that are quite different from each other. Why, for instance, would one of skill substitute the fluid resole resin of '277 for the solid novolak resin of '446? Further, whereas the '446 reference teaches a final pulverization of carbon material after the orderly curing, carbonization and activation of the starting material to prepare a material which is then shaped into an electrode, '277, on the other hand, teaches the necessary curing of the fluid starting material to give a molding, before the essential

sequence of steps of carbonization and activation, with no pulverization whatever shown or suggested for the carbon material of the reference. In fact, in view of the sequence of steps described in the reference, an attempt to include a pulverization step would be intrusive and detrimental to the process described. Even if somehow the skilled artisan would be motivated by the references to make material alterations of the processes described, how would the skilled artisan arrive at the steps of the present process in the necessary steps described in sequence?

The second criterion is that there must be a reasonable expectation of success. Appellants wonder how one of skill in the art could possibly expect success if, for instance, the process of '277 is modified to include a pulverization step (taught by '446) after the essential step of curing the described fluid resin composition to a molded object in the shape of an electrode before the concluding steps of carbonization and activation?

The third criterion is the references must teach or suggest <u>all</u> of the claim limitations. This clearly is not done in the present situation because <u>no</u> reference teaches a liquid starting material in which the phenol resin component is said to have a boiling point range of 120° to 400° C and a viscosity range of 0.1 to 100 Pa·s at 25° C. '446 teaches a solid <u>novolak</u> resin and '277 teaches a fluid <u>resole</u> phenol resin containing composition where no indication is given of the boiling point and viscosity of the resin. Clearly, the cited prior art in this case does not teach or suggest <u>all</u> claim limitations.

The Examiner has additionally applied the JP '915 and JP '092 references in combination with the '446 and '277 references discussed above. However, the '092 reference is completely irrelevant to any of the claims that have been rejected because it is directed to the aspect of the composition of an electrolyte liquid for a capacitor. More in particular, the reference describes the addition of maleic acid or salt thereof and salicylic acid or salt thereof

to an electrolyte system of a particular salt of benzoic acid in butyrolactone. Such a disclosure is of no relevance to the present claims, and therefore it adds nothing to the rejection of the primary references employed to reject the present claims.

The '915 is also believed to be of very limited relevance to the invention. In fact, the disclosure of the reference appears to describe a procedure similar to that of the '277 reference in that a foaming agent, curing agent and foam stabilizer are added to a phenol resin of the resole type. In the process of the reference, the indicated resin containing material is shaped into the form of a molding where it is cured. It is foamed and then cured. Clearly, the procedure described is completely unlike that of the present invention. Further, if combined with the '277 reference, it adds nothing thereto to make the reference any more relevant to the present invention as claimed. Moreover, the reference nowhere shows or suggests a carbonaceous material having the porosity characteristics of present Claims 17 and 31. Clearly, the combined references do not suggest the aspects of the invention of Claims 17, 31, and 38.

For the reasons expressed above, the process of Claim 44 is not suggested by the above cited combination of four references. The process of Claim 44 is very similar to the process of Claim 38. The only significant differences are that the process of Claim 44 requires a curing agent in combination with the thermosetting resin and the thermosetting resin is more narrowly defined in terms of a boiling point range of 150° to 380° C and a viscosity range of 0.2 to 80 Pa·s. Otherwise, the basic steps of the two claimed processes are the same. Because, as seen above, none of the references teach or suggest a liquid thermosetting resin having a certain boiling range characteristic and a certain viscosity range characteristic, the references do not suggest the thermosetting resin component of the present process, besides which they do not suggest the sequence of steps of the present process.

Again, appellants rigorously disagree with the Examiner's assessment of the relevance of the '446 reference at page 9, second paragraph of the Action where he states that '446 describes at least an obvious variation of the present carbonaceous product and process for making the same, as well as the same double layer capacitor. In fact, as seen above, appellants have specifically demonstrated on the record by way of the declaration of June 5, 2003, that the different process of '446 produces a product different from that presently claimed. Again, '446 requires the use of a solid novolak resin starting material which is cut in the shape of cubes which are thereafter carbonized and then activated and finally ground into a powder. This is not the sequence of steps of either Claim 38 or 44.

CLAIMS 18-20

As is evident from the discussion above, none of the cited and applied references teach or suggest a carbonaceous product useful as an electrode having specific well defined volume % ranges of micropores, mesopores and macropores. Thus, not only do they not suggest the specific ranges found in Claim 17, they do not suggest the ranges of Claims 18-20. Accordingly, Claims 18-20 stand patentably distinct over the prior art.

CLAIM 23

None of the cited and applied references show or suggest a total pore volume for a carbonaceous material ranging from 0.85 to 1.44 cm^3/g. Accordingly, Claim 23 stands patentably distinct over the cited and applied prior art.

CLAIM 39

None of the references cited and applied teach or suggest the addition of both a curing agent and curing accelerator in a thermosetting resin composition. Accordingly, this claim is believed to be patentably distinct over the cited and applied prior art.

CLAIM 43

The subject matter of Claim 43 is believed patentably distinguished over the cited and applied prior art for the same reasons Claims 17 and 31 are distinguished over the prior art.

CLAIM 45

Claim 45 is believed patentable over the prior art for the same reason Claim 39 is believed patentably distinguished over the prior art. The prior art does not show or suggest the combined use of a curing agent and a curing accelerator for the thermosetting resin.

CLAIM 48

The subject matter of Claim 48 is believed patentably distinguished over the cited and applied prior art for the same reasons Claims 17, 31 and 43 are distinguished over the prior art.

CLAIM 49

None of the cited and applied prior art references teach or suggest a thermosetting resin material that has the boiling point range and viscosity characteristics that are set forth in Claims 38 and 44. Certainly none of these references teach or suggest the narrower ranges of Claim 49. Thus, Claim 49 is believed distinguished over the prior art.

It is believed that the decision by the Examiner to continue the rejection of the claims is erroneous and that the decision by the Examiner should be REVERSED.

Respectfully submitted,

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APPENDIX

CLAIMS ON APPEAL

Claim 17. A carbonaceous material which has a total pore volume of from 0.5 to 1.5 cm^3/g per unit mass, a volume of micropores having diameters of from 10 to 20 Å of from 10 to 45 % based on the total pore volume, a volume of mesopores having diameters of from 20 to 200 Å of from 35 to 65 % based on the total pore volume, a volume of macropores having diameters exceeding 200 Å of not more than 15 % based on the total pore volume, and a specific surface area of from 1,000 to 2,500 m^2/g.

Claim 18. The carbonaceous material of Claim 17, wherein the volume of micropores having diameters of from 10 to 20 Å is from 10 to 25 % based on the total pore volume.

Claim 19. The carbonaceous material of Claim 17, wherein the volume of mesopores having diameters of from 20 to 200 Å is from 40 to 60 % based on the total pore volume.

Claim 20. The carbonaceous material of Claim 17, wherein the volume of macropores having diameters exceeding 200 Å is not more than 10 % based on the total pore volume.

Claim 21. The carbonaceous material of Claim 17, wherein the specific surface area is from 1,000 to 2,200 m^2/g.

Claim 22. The carbonaceous material of Claim 21, wherein the specific surface area is from 1,000 to 1,500 m^2/g.

Claim 23. The carbonaceous material of Claim 17, having a total pore volume of from 0.85 to 1.44 cm^3/g.

Claim 24. The carbonaceous material of Claim 21, having a specific surface area of from 1,500 to 2,100 m^2/g.

Claim 31. An electric double layer capacitor having electrodes comprising a carbonaceous material having a total pore volume of from 0.5 to 1.5 cm^3/g per unit mass, a volume of

micropores having diameters of from 10 to 20 Å of from 10 to 45 % based on the total pore volume, a volume of mesopores having diameters of from 20 to 200 Å of from 35 to 65 % based on the total pore volume, a volume of macropores having diameters exceeding 200 Å of not more than 15 % based on the total pore volume, and a specific surface area of from 1,000 to 2,500 m^2/g.

Claim 32. The electric double layer capacitor of Claim 31, which has an organic electrolyte solution.

Claim 33. The electric double layer capacitor of Claim 32, wherein the organic electrolyte solution contains at least one solvent selected from the group consisting of ethylene carbonate, propylene carbonate, butylene carbonate, dimethyl carbonate, ethyl methyl carbonate, diethyl carbonate, acetonitrile, glutaronitrile, valeronitrile, sulfolane,and a 3-methylsulfolane, and a salt comprising a quaternary onium cation represented by $R^1R^2R^3R^4N^+$ or $R^1R^2R^3R^4P^+$, wherein each of R^1, R^2, R^3 and R^4, which is independent of one another, is a C_{1-6} alkyl group, and at least one anion selected from the group consisting of BF_4^-, PF_6^-, ClO_4^-, $CF_3SO_3^-$ and $(SO_2R^5)(SO_2R^6)N^+$, wherein each of R^5 and R^6, which is each independent of one another, is a C_{1-4} alkyl group.

Claim 38. A process for producing an electric double layer capacitor having electrodes comprising a porous carbonaceous material and a binder, wherein the carbonaceous material is obtained by the steps of:

(1) curing a liquid thermosetting resin which contains a volatile component having a boiling point of from 120 to 400° C and which has a viscosity of from 0.1 to 100 Pa·s at 25° C to obtain a cured product;

(2) pulverizing the cured product;

(3) carbonizing the pulverized, cured product in a non-oxidizing atmosphere so that the mass reduction till 400° C in the carbonization is from 2 to 50 mass % of the mass before carbonization, to obtain a carbonized product; and

(4) activating the carbonized product.

Claim 39. The process of Claim 38, wherein, in the step (1), a curing agent is added to the thermosetting resin, followed by kneading, and further, a curing accelerator is added thereto, followed by kneading to obtain a kneaded product, and then said kneaded product is cured to obtain a cured product.

Claim 40. The process of Claim 39, wherein the curing agent is added in an amount of at least 1 mass % based on the thermosetting resin.

Claim 41. The process of Claim 38, wherein the curing accelerator is added in an amount of at most 5 mass % based on the thermosetting resin.

Claim 42. The process of Claim 38, wherein the thermosetting resin is a phenolic resin.

Claim 43. The process of Claim 38, wherein after the step (4) has been completed, the carbonaceous material has a total pore volume of from 0.5 to 1.5 cm^3/g per unit mass, a volume of micropores having diameters of from 10 to 20 Å of from 10 to 45 % based on the total pore volume, a volume of mesopores having diameters of from 20 to 200 Å of from 35 to 65 % based on the total pore volume, a volume of macropores having diameters exceeding 200 Å of not more than 15 % based on the total pore volume, and a specific surface area of from 1,000 to 2,500 m^2/g.

Claim 44. A process for producing a porous carbonaceous material, which comprises the steps of:

(1) combining a liquid thermosetting resin which contains a volatile component having a boiling point of from 150° to 380° C and which has a viscosity of from 0.2 to 80 Pa·s at 25° and at least 1 mass % of a curing agent, based on the thermosetting resin;

(2) curing the resin to form a cured product;

(3) pulverizing the cured product;

(4) carbonizing the pulverized cured product in a non-oxidizing atmosphere so that the mass reduction which occurs upon heating up to a temperature of 400° C during carbonization ranges from 2 to 50 mass % of the mass before carbonization, thereby obtaining a carbonized product; and

(5) activating the carbonized product.

Claim 45. The process of Claim 44, wherein after the addition of the curing agent to the thermosetting resin in step (1), kneading is effected and then a curing accelerator is added thereto, and then further kneading is effected, and then the kneaded product is cured to obtain a cured product.

Claim 46. The process of Claim 44, wherein the curing accelerator is added in an amount of at most 5 mass % based on the thermosetting resin.

Claim 47. The process of Claim 44, wherein the thermosetting resin is a phenolic resin.

Claim 48. The process of Claim 44, wherein after the carbonized product has been activated in step (5), the carbonaceous material has a total pore volume ranging from 0.5 to 1.5 cm^3/g per unit mass, a volume of micropores having diameters ranging from 10 to 20 Å of from 10 to 45 % based on the total pore volume, a volume of mesopores having diameters of from 20 to 200 Å of from 35 to 65 % based on the total pore volume, a volume of macropores having diameters exceeding 200 Å of not more than 15 % based on the total pore volume, and a specific surface area of from 1,000 to 2,500 m^2/g.

Claim 49. The process of Claim 44, wherein the boiling point of the liquid thermosetting resin ranges from 180 to 350° C and the viscosity of the liquid ranges from 0.5 to 50 Pa•s.

FINDINGS OF FACT

1. The JP '446 reference discloses a process of preparing a carbon material for use as an electrode(s) in an electric double layer capacitor(s) which employs, as a preferred carbon containing starting material, a solid novolak phenol-formaldehyde resin. No other resin starting material is shown by the reference. In succession, as described in Experiment 1 of the U. S. Patent 5,603,867, which in-part is based on the disclosure of JP '446, are the steps of i) curing the solid novolak resin, ii) reducing the obtained solid block of cured resin to 2 mm square cubes, iii) carbonizing the cubes at 900° C, iv) activating the cubes at 900° C under an atmosphere of CO_2 and then v) finally grinding (pulverizing) the cubes to a powder. This sequence of steps is not that of the present process embodiments of curing a liquid resin, pulverizing the cured resin to a powder, and carbonizing and then activating the powder.

2. The JP '277 reference discloses a process of preparing a porous carbon material for use as an electrode(s) in an electric double layer capacitor(s) which employs, as a preferred carbon containing starting material, a resole (A-stage resin) type phenol-formaldehyde resin blended with a surfactant, an oxyalkylene compound or glycerol and a high-boiling lipophilic compound. The resin composition is cured and then molded into an electrode. Thereafter, the molded object is carbonized and then activated. This sequence of steps, which lacks a pulverization step, is not that of the present process.

3. The JP '092 reference is directed to an organic electrolyte solution for an electrolytic capacitor.

4. The JP '915 reference describes the preparation of electrodes for an electric double layer capacitor(s) from a resin material based on a resole type phenol resin, a foaming agent, a foam stabilizer and a curing agent. The material is cured to form a molded, foamed electrode, followed by carbonization and activation. Similarities exist between the procedure of this

reference and the above-mentioned JP '277 reference. The sequence of steps of this reference is not the sequence of steps of process embodiments of the present invention.

CONCLUSIONS OF LAW

1. Claims 17-24, 31, 38, 42 and 43 are not obvious over JP 06-216,446 in view of JP 4-175,277 within the meaning of 35 USC 103(a).

2. Claims 17-24, 31 and 38-43 are not obvious over JP 06-216,446 in view of JP 4-175,277 and further in view of JP 5-243,092 and JP 2-297,915 within the meaning of 35 USC 103(a).

3. Claims 17-24, 31, 32, 33 and 38-43 are not obvious over JP 06-216,446 in view of JP 4-175,277 and further in view of JP 5-243,092 and JP 2-297,915 and still further in view of Hiratsuka et al, U.S. Patent 5,754,393 within the meaning of 35 USC 103(a).

4. Claims 44-49 are not obvious over JP 06-216,446 in view of JP 4-175,277 and further in view of JP 5-243,092 and JP 2-297,915 within the meaning of 35 USC 103(a)..

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IN THE UNITED STATES PATENT & TRADEMARK OFFICE

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FOR: CARBONACEOUS MATERIAL, ITS PRODUCTION PROCESS AND ELECTRIC DOUBLE LAYER CAPACITOR EMPLOYING IT	:

APPEAL BRIEF

COMMISSIONER FOR PATENTS
ALEXANDRIA, VA. 22313

SIR:

The following is an appeal to the Board of Appeals concerning the final decision by the Examiner to reject Claims 17-24, 31-33 and 38-49 of the above-identified application.

REAL PARTY IN INTEREST

ASAHI GLASS Co. Ltd. and ADCHEMCO Corp. are the real parties of interest in the above-identified application.

RELATED APPEALS AND INTERFERENCES

There are no appeals or interferences before the Board of Appeals in applications related to the present application.

STATUS OF CLAIMS

Claims 1-16, 25-30 and 34-37 have been canceled. Claims 17-24, 31-33 and 38-49 are under active consideration.

STATUS OF AMENDMENTS

No amendment in response to the Office Action dated May 30, 2003 has been filed.

SUMMARY OF THE INVENTION

The present invention is directed to a carbonaceous material which has a total pore volume of from 0.5 to 1.5 cm^3/g per unit mass, a volume of micropores having diameters of from 10 to 20 Å of from 10 to 45 % based on the total pore volume, a volume of mesopores having diameters of from 20 to 200 Å of from 35 to 65 % based on the total pore volume, a volume of macropores having diameters exceeding 200 Å of not more than 15 % based on the total pore volume, and a specific surface area of from 1,000 to 2,500 m^2/g.

Another aspect of the invention is an electric double layer capacitor that has electrodes which comprise a carbonaceous material having the characteristics stated above.

Still another aspect of the invention is a process for producing an electric double layer capacitor having electrodes comprising a porous carbonaceous material and a binder, wherein the carbonaceous material is prepared by (1) curing a liquid thermosetting resin which contains a volatile component having a boiling point of from 120 to 400° C and which has a viscosity of from 0.1 to 100 Pa·s at 25° C to obtain a cured product, (2) pulverizing the cured product, (3) carbonizing the pulverized, cured product in a non-oxidizing atmosphere so that the mass reduction till 400° C in the carbonization is from 2 to 50 mass % of the mass

before carbonization, to obtain a carbonized product, and (4) activating the carbonized product.

A second process embodiment for producing a porous carbonaceous material comprises (1) combining a liquid thermosetting resin which contains a volatile component having a boiling point ranging from 150° to 380° C and which has a viscosity ranging from 0.2 to 80 Pa·s at 25° C and at least 1 mass % of a curing agent, based on the thermosetting resin, (2) curing the resin to form a cured product, (3) pulverizing the cured product, (4) carbonizing the pulverized cured product in a non-oxidizing atmosphere so that the mass reduction which occurs upon heating up to a temperature of 400° C during carbonization ranges from 2 to 50 mass % of the mass before carbonization, thereby obtaining a carbonized product, and (5) activating the carbonized product.

Support for the various aspects of the invention can be found on pages 8 and 9 of the text, as well as the paragraph bridging pages 12 and 13 and the paragraph bridging pages 16 and 17 of the text. The latter portions of text are particularly relevant to Claim 44..

ISSUES

1. Whether Claims 17-24, 31, 38, 42 and 43 are obvious based on 35 USC 103(a) over JP 06-216,446 in view of JP 4-175,277.

2. Whether Claims 17-24, 31 and 38-43 are obvious based on 35 USC 103(a) over JP 06-216,446 in view of JP 4-175,277 and further in view of JP 5-243,092 and JP 2-297,915.

3. Whether Claims 17-24, 31, 32, 33 and 38-43 are obvious based on 35 USC 103(a) over JP 06-216,446 in view of JP 4-175,277 and further in view of JP 5-243,092 and JP 2-297,915 and still further in view of Hiratsuka et al, U.S. Patent 5,754,393.

4. Whether Claims 44-49 are obvious based on 35 USC 103(a) over JP 06-216,446 in view of JP 4-175,277 and further in view of JP 5-243,092 and JP 2-297,915.

GROUPING OF CLAIMS

Claims 18-20, 23, 39, 43, 45, 48 and 49 do not stand or fall together with the independent claims.

ARGUMENT

As appellants have stated on the record, the JP 06-216,446 in disclosing a method of preparing a carbonized product for use as a an active carbon electrode, merely describes the use of a phenolic resin as the starting material for the preparation of activated carbon, but fails to disclose whether the phenolic resin is liquid or solid. This fact is significant because in order to prepare a carbonaceous material as claimed in Claim 17 (31), it is essential to start with a liquid thermosetting resin as described in Claim 38 which has the stated boiling point range and viscosity range as determined at 25° C. On the other hand, in describing the preparation of the carbon material of the patent, all that is mentioned in the patent is that a solid carbon containing material is used such as coconut shell char, wood, coal, pitch, natural macromolecules or synthetic macromolecules, with phenol resin preferred. The examples only speak of a novolak type phenol resin. However, none of these materials when processed to a carbonized and activated product result in the carbonaceous product of the present invention. This fact has been clearly demonstrated by the experiment described and presented in the Declaration (37 CFR 1.132) filed June 5, 2003 (a copy is enclosed) where a solid novolak type phenol resin is processed as described in the '446 reference. The result of the experiment is that a carbonized product is obtained that has a micropore, mesopore,

macropore distribution completely outside the content ranges required of the claimed carbonaceous material of the present invention (see the table below).

Pore Volumes	Claim 17 of present application	Carbonized product of the '446 reference
Volume of micropores having diameters of 10-20 Å	10 - 45 %	27 %
Volume of mesopores having diameters of 20-200 Å	35 -65 %	15 %
Volume of macropores having diameters greater than 200 Å	at most 20 %	9 %

It is clear from the data above that the carbonized product of the reference has a volume of mesopore content well outside the required range of the present claims which means that in view of the function of mesopores which is to supply electrolyte ions within the carbon product to the micropores within the carbon material, the carbon product of the reference is materially and obviously different from the claimed product of the present invention. (Appellants in this regard refer to the important discussion in the specification regarding the different roles of micropores, mesopores and macropores within a carbon electrode. In particular, appellants direct attention of the reader to the discussion on pages 3-7 and, in particular, the discussion from page 9, line 18 to page 12, line 19. The amounts of micropores, mesopores and macropores within a carbon electrode are very important if the electrical characteristics of an electric double layer capacitor are to be maximized.)

The Examiner seems to make an issue of appellants' statement concerning the lack of disclosure in the reference of the use of a solid or liquid resin. Obviously, however, if the novolak resin of the reference is a solid, it **can not** have the viscosity and boiling point

characteristics of the liquid thermosetting resin starting material of the present claims. On the other hand, if the novolak phenolic resin of the reference is liquid, there is no disclosure in the reference that teaches the boiling point and viscosity ranges of the present claims, nor is there any disclosure that teaches that these characteristics are in any way important in obtaining a carbonized product that exhibits improved electrical properties as an electrode of a capacitor!

At this point in the discussion appellants believe that the importance of using the volatile component of the present invention having a particular boiling point range and viscosity range should be established. On fact, attention is directed to Comparative Examples 1, 2, 4 and 9 of the specification. Specifically, in Comparative Example 1, the volatile component has a viscosity of 0.08 Pa·s, whereas in Comparative Example 2, the volatile component has a viscosity of 120 Pa·s. That is, in Comparative Example 1, the viscosity is below that required in accordance with the present invention, whereas in Comparative Example 2, the viscosity is above that required by the present invention.

In Comparative Example 4, the volatile component has a boiling point ranging from 390° to 460°C, which is higher than that required by the present invention. Additionally, in Comparative Example 9, a curing agent is not used, unlike that of the present process.

The results of these comparative examples are shown in Table 1. Comparative Example 1 provides a product in which the amount of mesopores is below that of the present invention. Comparative Examples 2 and 4 also afford products having too few mesopores as compared to the product of the present invention. Comparative Example 2 also provides a product having a pore volume which is below that of the present invention, whereas Comparative Example 9 affords a pore volume which is too high relative to the present invention.

Furthermore, in all of Comparative Examples 1, 2, 4 and 9, the capacitances obtained are too low and the internal resistances (electrical resistivity) are much higher than obtained in the product of the present invention. Clearly, there is a direct influence of the boiling point and viscosity of the volatile component on the resulting pore structure of the carbonaceous material produced. Clearly, '446 does not teach or suggest the carbonaceous product of the invention, nor does it teach or suggest the process embodiments of the invention for producing the present product.

In this connection the Examiner alleges at page 13, last paragraph of the final Office Action that the phenolic resin of the JP '277 reference, also cited against the present claims, is the same as that of '446 and that of the present invention. Appellants do not comprehend how such a conclusion can be reached since the inventive entity/assignee designations of the '277 and '446 references are totally different and because the types of phenolic resins used in the two references are substantially different because '446 uses a **novolak** phenolic resin and '277 uses a **resol** type phenolic resin. Anyone of skill in the art knows that a novolak resin is fundamentally of different structure than an A-stage resole resin.

Appellants also note that a material difference between the claimed process of the invention and the process of '446 is that in the present invention, the resin employed is cured and the cured material obtained is then pulverized, followed by carbonization. On the other hand, in '446, primary activation of the carbonaceous material is conducted subsequent to carbonization, followed by grinding of the cured product. (See Experiment 1 of the '867 U. S. Patent.) The significance of this basic difference in process is that when a material within the scope of the present invention is subjected to carbonization, desorption of volatile components during the operation occurs which results in the formation of mesopores. Because the present claims require pulverization of the cured resin prior to carbonization,

mesopores tend to be formed in the product with uniformity. On the other hand, if a cured product in the form of a block is carbonized such as taught by '446, mesopores are formed in a non-uniform manner. Moreover, if a cured product is carbonized without pulverization, hard charcoal forms as blocks. Subsequent pulverization then tends to be troublesome and takes a long time. Thus, there are very material differences between the present invention as claimed in Claims 17, 31 and 38 and the process disclosed in '446.

Turning to the JP 4-175,277 reference, the same describes the use of a liquid phenolic resin (resol type) as a material to produce activated carbon. However, an evaporation type foaming agent is mixed into the resin for treatment, the result of which, upon carbonization and activation, is the formation of a substantial amount of macropores having pore diameters in excess of 200 Å. This fact is particularly noteworthy in view of the specific distribution of micropores, mesopores and macropores in the product of the present invention, which distribution of the three types of pores in a carbon product is not taught or suggested by '277. In view of the formation of substantial amounts of macropores in the product of the reference because of the use of a foaming agent, the carbon product of the reference has a very different micropore/mesopore/macropore distribution in comparison to the carbonaceous product of the present invention. The process of the present invention, fundamentally is quite different from that of the '277 reference. As is clear from the abstract of the reference a sheet of material is prepared from the mixture of the reference containing surfactant and other ingredients, which is subsequently cured and then carbonized. The carbonized sheet is used as an electrode. On the other hand, in the present invention an activated carbon powder is obtained which is formulated with a binder to form a sheet electrode. Thus, it is clear that the process of the reference is very different, not only from that of the present invention, but also that of the '446 disclosure. In fact, it is not clear how the two references can be combined to

suggest the present process. Whereas the '446 reference requires the curing of a solid novolak type phenolic resin followed by fracturing of the cured material into relatively large size square cubes which are then carbonized and then activated followed by pulverization, the '277 reference shapes the mixture noted above of a resol type phenolic resin and surfactant as well as other ingredients into the shape of an electrode which is then followed by curing, carbonization and activation of the shaped material. Thus, the two procedures are so different, it is not apparent how the two can be combined in some reasonable manner, and certainly not in a way in which the two references suggest either the product of the present invention or the process by which the product is made.

As to the combination of the two references, the Examiner states in paragraph (e) on page 16 of the Office Action that the combination of the two references will result in a "product that will produce a product" having the same inherent micropores since the processes are the same. Besides the fact that a product can not produce a product, it is not clear how it is apparent that the products of the two references inherently apparently have the same volume of mesopores. How does the Examiner arrive at this conclusion? In fact, the two products of the references can not have the "same inherent mesopores" because the processes of the two references are obviously not the same, but rather as noted above are quite different from each other.

The Examiner states on page 5 of the Office Action (reference is also made to comments of paragraph (g) on page 17 of the Office Action) that it would be obvious to one of skill to combine the teachings of '446 and '277 with respect to the resin formulations described and somehow arrive at the resin used in the present process. In view of the fact that '446 only describes the curing of a novolak resin, why would one of skill employ the "glycerols" and/or "oxyalkylene compounds" which make-up a formulation of '277 in which

a liquid A-stage resole type phenolic resin is used when the disclosure of '446 requires the presence of no such ingredients with the solid novolak resin. Even if one of skill made such a modification, how does one arrive at the thermosetting resin starting material of the present process which must have the particular boiling point range and viscosity range as stated? Appellants are therefore of the opinion that the cited and applied references do not suggest any of the claimed aspects of the present invention.

Appellants wish to emphasize that in order to establish a *prima facie* case of obviousness, three criteria must be met. The first is that there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art to modify the reference or to combine reference teachings. In the present situation each of the '446 and '277 references describes a separate method of forming an electrode by an orderly progression of steps, each of which sequence of steps starts with a specified thermosetting resin formulation . In fact, '446 describes only a first step of curing a solid novolak phenol resin while '277 describes the curing of a resin containing composition, not based on a novolak resin, but based on a resole (A-stage phenol resin) (fluid) that is used in combination with a surfactant, an oxyalkylene compound or glycerol and a high-boiling lipophilic compound. In view of the very substantial difference in starting materials, why would one of skill in the art be led to make substantive changes to the make-up of resin starting materials in overall processes that are quite different from each other. Why, for instance, would one of skill substitute the fluid resole resin of '277 for the solid novolak resin of '446? Further, whereas the '446 reference teaches a final pulverization of carbon material after the orderly curing, carbonization and activation of the starting material to prepare a material which is then shaped into an electrode, '277, on the other hand, teaches the necessary curing of the fluid starting material to give a molding, before the essential

sequence of steps of carbonization and activation, with no pulverization whatever shown or suggested for the carbon material of the reference. In fact, in view of the sequence of steps described in the reference, an attempt to include a pulverization step would be intrusive and detrimental to the process described. Even if somehow the skilled artisan would be motivated by the references to make material alterations of the processes described, how would the skilled artisan arrive at the steps of the present process in the necessary steps described in sequence?

The second criterion is that there must be a reasonable expectation of success. Appellants wonder how one of skill in the art could possibly expect success if, for instance, the process of '277 is modified to include a pulverization step (taught by '446) after the essential step of curing the described fluid resin composition to a molded object in the shape of an electrode before the concluding steps of carbonization and activation?

The third criterion is the references must teach or suggest <u>all</u> of the claim limitations. This clearly is not done in the present situation because <u>no</u> reference teaches a liquid starting material in which the phenol resin component is said to have a boiling point range of 120° to 400° C and a viscosity range of 0.1 to 100 Pa·s at 25° C. '446 teaches a solid <u>novolak</u> resin and '277 teaches a fluid <u>resole</u> phenol resin containing composition where no indication is given of the boiling point and viscosity of the resin. Clearly, the cited prior art in this case does not teach or suggest <u>all</u> claim limitations.

The Examiner has additionally applied the JP '915 and JP '092 references in combination with the '446 and '277 references discussed above. However, the '092 reference is completely irrelevant to any of the claims that have been rejected because it is directed to the aspect of the composition of an electrolyte liquid for a capacitor. More in particular, the reference describes the addition of maleic acid or salt thereof and salicylic acid or salt thereof

to an electrolyte system of a particular salt of benzoic acid in butyrolactone. Such a disclosure is of no relevance to the present claims, and therefore it adds nothing to the rejection of the primary references employed to reject the present claims.

The '915 is also believed to be of very limited relevance to the invention. In fact, the disclosure of the reference appears to describe a procedure similar to that of the '277 reference in that a foaming agent, curing agent and foam stabilizer are added to a phenol resin of the resole type. In the process of the reference, the indicated resin containing material is shaped into the form of a molding where it is cured. It is foamed and then cured. Clearly, the procedure described is completely unlike that of the present invention. Further, if combined with the '277 reference, it adds nothing thereto to make the reference any more relevant to the present invention as claimed. Moreover, the reference nowhere shows or suggests a carbonaceous material having the porosity characteristics of present Claims 17 and 31. Clearly, the combined references do not suggest the aspects of the invention of Claims 17, 31, and 38.

For the reasons expressed above, the process of Claim 44 is not suggested by the above cited combination of four references. The process of Claim 44 is very similar to the process of Claim 38. The only significant differences are that the process of Claim 44 requires a curing agent in combination with the thermosetting resin and the thermosetting resin is more narrowly defined in terms of a boiling point range of 150° to 380° C and a viscosity range of 0.2 to 80 Pa·s. Otherwise, the basic steps of the two claimed processes are the same. Because, as seen above, none of the references teach or suggest a liquid thermosetting resin having a certain boiling range characteristic and a certain viscosity range characteristic, the references do not suggest the thermosetting resin component of the present process, besides which they do not suggest the sequence of steps of the present process.

Again, appellants rigorously disagree with the Examiner's assessment of the relevance of the '446 reference at page 9, second paragraph of the Action where he states that '446 describes at least an obvious variation of the present carbonaceous product and process for making the same, as well as the same double layer capacitor. In fact, as seen above, appellants have specifically demonstrated on the record by way of the declaration of June 5, 2003, that the different process of '446 produces a product different from that presently claimed. Again, '446 requires the use of a solid novolak resin starting material which is cut in the shape of cubes which are thereafter carbonized and then activated and finally ground into a powder. This is not the sequence of steps of either Claim 38 or 44.

CLAIMS 18-20

As is evident from the discussion above, none of the cited and applied references teach or suggest a carbonaceous product useful as an electrode having specific well defined volume % ranges of micropores, mesopores and macropores. Thus, not only do they not suggest the specific ranges found in Claim 17, they do not suggest the ranges of Claims 18-20. Accordingly, Claims 18-20 stand patentably distinct over the prior art.

CLAIM 23

None of the cited and applied references show or suggest a total pore volume for a carbonaceous material ranging from 0.85 to 1.44 cm^3/g. Accordingly, Claim 23 stands patentably distinct over the cited and applied prior art.

CLAIM 39

None of the references cited and applied teach or suggest the addition of both a curing agent and curing accelerator in a thermosetting resin composition. Accordingly, this claim is believed to be patentably distinct over the cited and applied prior art.

CLAIM 43

The subject matter of Claim 43 is believed patentably distinguished over the cited and applied prior art for the same reasons Claims 17 and 31 are distinguished over the prior art.

CLAIM 45

Claim 45 is believed patentable over the prior art for the same reason Claim 39 is believed patentably distinguished over the prior art. The prior art does not show or suggest the combined use of a curing agent and a curing accelerator for the thermosetting resin.

CLAIM 48

The subject matter of Claim 48 is believed patentably distinguished over the cited and applied prior art for the same reasons Claims 17, 31 and 43 are distinguished over the prior art.

CLAIM 49

None of the cited and applied prior art references teach or suggest a thermosetting resin material that has the boiling point range and viscosity characteristics that are set forth in Claims 38 and 44. Certainly none of these references teach or suggest the narrower ranges of Claim 49. Thus, Claim 49 is believed distinguished over the prior art.

It is believed that the decision by the Examiner to continue the rejection of the claims is erroneous and that the decision by the Examiner should be REVERSED.

Respectfully submitted,

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APPENDIX

CLAIMS ON APPEAL

Claim 17. A carbonaceous material which has a total pore volume of from 0.5 to 1.5 cm^3/g per unit mass, a volume of micropores having diameters of from 10 to 20 Å of from 10 to 45 % based on the total pore volume, a volume of mesopores having diameters of from 20 to 200 Å of from 35 to 65 % based on the total pore volume, a volume of macropores having diameters exceeding 200 Å of not more than 15 % based on the total pore volume, and a specific surface area of from 1,000 to 2,500 m^2/g.

Claim 18. The carbonaceous material of Claim 17, wherein the volume of micropores having diameters of from 10 to 20 Å is from 10 to 25 % based on the total pore volume.

Claim 19. The carbonaceous material of Claim 17, wherein the volume of mesopores having diameters of from 20 to 200 Å is from 40 to 60 % based on the total pore volume.

Claim 20. The carbonaceous material of Claim 17, wherein the volume of macropores having diameters exceeding 200 Å is not more than 10 % based on the total pore volume.

Claim 21. The carbonaceous material of Claim 17, wherein the specific surface area is from 1,000 to 2,200 m^2/g.

Claim 22. The carbonaceous material of Claim 21, wherein the specific surface area is from 1,000 to 1,500 m^2/g.

Claim 23. The carbonaceous material of Claim 17, having a total pore volume of from 0.85 to 1.44 cm^3/g.

Claim 24. The carbonaceous material of Claim 21, having a specific surface area of from 1,500 to 2,100 m^2/g.

Claim 31. An electric double layer capacitor having electrodes comprising a carbonaceous material having a total pore volume of from 0.5 to 1.5 cm^3/g per unit mass, a volume of

micropores having diameters of from 10 to 20 Å of from 10 to 45 % based on the total pore volume, a volume of mesopores having diameters of from 20 to 200 Å of from 35 to 65 % based on the total pore volume, a volume of macropores having diameters exceeding 200 Å of not more than 15 % based on the total pore volume, and a specific surface area of from 1,000 to 2,500 m^2/g.

Claim 32. The electric double layer capacitor of Claim 31, which has an organic electrolyte solution.

Claim 33. The electric double layer capacitor of Claim 32, wherein the organic electrolyte solution contains at least one solvent selected from the group consisting of ethylene carbonate, propylene carbonate, butylene carbonate, dimethyl carbonate, ethyl methyl carbonate, diethyl carbonate, acetonitrile, glutaronitrile, valeronitrile, sulfolane,and a 3-methylsulfolane, and a salt comprising a quaternary onium cation represented by $R^1R^2R^3R^4N^+$ or $R^1R^2R^3R^4P^+$, wherein each of R^1, R^2, R^3 and R^4, which is independent of one another, is a C_{1-6} alkyl group, and at least one anion selected from the group consisting of BF_4^-, PF_6^-, ClO_4^-, $CF_3SO_3^-$ and $(SO_2R^5)(SO_2R^6)N^+$, wherein each of R^5 and R^6, which is each independent of one another, is a C_{1-4} alkyl group.

Claim 38. A process for producing an electric double layer capacitor having electrodes comprising a porous carbonaceous material and a binder, wherein the carbonaceous material is obtained by the steps of:

(1) curing a liquid thermosetting resin which contains a volatile component having a boiling point of from 120 to 400° C and which has a viscosity of from 0.1 to 100 Pa·s at 25° C to obtain a cured product;

(2) pulverizing the cured product;

(3) carbonizing the pulverized, cured product in a non-oxidizing atmosphere so that the mass reduction till 400° C in the carbonization is from 2 to 50 mass % of the mass before carbonization, to obtain a carbonized product; and

(4) activating the carbonized product.

Claim 39. The process of Claim 38, wherein, in the step (1), a curing agent is added to the thermosetting resin, followed by kneading, and further, a curing accelerator is added thereto, followed by kneading to obtain a kneaded product, and then said kneaded product is cured to obtain a cured product.

Claim 40. The process of Claim 39, wherein the curing agent is added in an amount of at least 1 mass % based on the thermosetting resin.

Claim 41. The process of Claim 38, wherein the curing accelerator is added in an amount of at most 5 mass % based on the thermosetting resin.

Claim 42. The process of Claim 38, wherein the thermosetting resin is a phenolic resin.

Claim 43. The process of Claim 38, wherein after the step (4) has been completed, the carbonaceous material has a total pore volume of from 0.5 to 1.5 cm^3/g per unit mass, a volume of micropores having diameters of from 10 to 20 Å of from 10 to 45 % based on the total pore volume, a volume of mesopores having diameters of from 20 to 200 Å of from 35 to 65 % based on the total pore volume, a volume of macropores having diameters exceeding 200 Å of not more than 15 % based on the total pore volume, and a specific surface area of from 1,000 to 2,500 m^2/g.

Claim 44. A process for producing a porous carbonaceous material, which comprises the steps of:

(1) combining a liquid thermosetting resin which contains a volatile component having a boiling point of from 150° to 380° C and which has a viscosity of from 0.2 to 80 Pa·s at 25° and at least 1 mass % of a curing agent, based on the thermosetting resin;

(2) curing the resin to form a cured product;

(3) pulverizing the cured product;

(4) carbonizing the pulverized cured product in a non-oxidizing atmosphere so that the mass reduction which occurs upon heating up to a temperature of 400° C during carbonization ranges from 2 to 50 mass % of the mass before carbonization, thereby obtaining a carbonized product; and

(5) activating the carbonized product.

Claim 45. The process of Claim 44, wherein after the addition of the curing agent to the thermosetting resin in step (1), kneading is effected and then a curing accelerator is added thereto, and then further kneading is effected, and then the kneaded product is cured to obtain a cured product.

Claim 46. The process of Claim 44, wherein the curing accelerator is added in an amount of at most 5 mass % based on the thermosetting resin.

Claim 47. The process of Claim 44, wherein the thermosetting resin is a phenolic resin.

Claim 48. The process of Claim 44, wherein after the carbonized product has been activated in step (5), the carbonaceous material has a total pore volume ranging from 0.5 to 1.5 cm^3/g per unit mass, a volume of micropores having diameters ranging from 10 to 20 Å of from 10 to 45 % based on the total pore volume, a volume of mesopores having diameters of from 20 to 200 Å of from 35 to 65 % based on the total pore volume, a volume of macropores having diameters exceeding 200 Å of not more than 15 % based on the total pore volume, and a specific surface area of from 1,000 to 2,500 m^2/g.

Claim 49. The process of Claim 44, wherein the boiling point of the liquid thermosetting resin ranges from 180 to 350° C and the viscosity of the liquid ranges from 0.5 to 50 Pa•s.

FINDINGS OF FACT

1. The JP '446 reference discloses a process of preparing a carbon material for use as an electrode(s) in an electric double layer capacitor(s) which employs, as a preferred carbon containing starting material, a solid novolak phenol-formaldehyde resin. No other resin starting material is shown by the reference. In succession, as described in Experiment 1 of the U. S. Patent 5,603,867, which in-part is based on the disclosure of JP '446, are the steps of i) curing the solid novolak resin, ii) reducing the obtained solid block of cured resin to 2 mm square cubes, iii) carbonizing the cubes at 900° C, iv) activating the cubes at 900° C under an atmosphere of CO_2 and then v) finally grinding (pulverizing) the cubes to a powder. This sequence of steps is not that of the present process embodiments of curing a liquid resin, pulverizing the cured resin to a powder, and carbonizing and then activating the powder.

2. The JP '277 reference discloses a process of preparing a porous carbon material for use as an electrode(s) in an electric double layer capacitor(s) which employs, as a preferred carbon containing starting material, a resole (A-stage resin) type phenol-formaldehyde resin blended with a surfactant, an oxyalkylene compound or glycerol and a high-boiling lipophilic compound. The resin composition is cured and then molded into an electrode. Thereafter, the molded object is carbonized and then activated. This sequence of steps, which lacks a pulverization step, is not that of the present process.

3. The JP '092 reference is directed to an organic electrolyte solution for an electrolytic capacitor.

4. The JP '915 reference describes the preparation of electrodes for an electric double layer capacitor(s) from a resin material based on a resole type phenol resin, a foaming agent, a foam stabilizer and a curing agent. The material is cured to form a molded, foamed electrode, followed by carbonization and activation. Similarities exist between the procedure of this

reference and the above-mentioned JP '277 reference. The sequence of steps of this reference is not the sequence of steps of process embodiments of the present invention.

CONCLUSIONS OF LAW

1. Claims 17-24, 31, 38, 42 and 43 are not obvious over JP 06-216,446 in view of JP 4-175,277 within the meaning of 35 USC 103(a).

2. Claims 17-24, 31 and 38-43 are not obvious over JP 06-216,446 in view of JP 4-175,277 and further in view of JP 5-243,092 and JP 2-297,915 within the meaning of 35 USC 103(a).

3. Claims 17-24, 31, 32, 33 and 38-43 are not obvious over JP 06-216,446 in view of JP 4-175,277 and further in view of JP 5-243,092 and JP 2-297,915 and still further in view of Hiratsuka et al, U.S. Patent 5,754,393 within the meaning of 35 USC 103(a).

4. Claims 44-49 are not obvious over JP 06-216,446 in view of JP 4-175,277 and further in view of JP 5-243,092 and JP 2-297,915 within the meaning of 35 USC 103(a)..